



R-25 M.Tech - JNTUK w. e. f. 2025 –26

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

COURSE STRUCTURE & SYLLABUS FOR
R25 M.Tech
MINING ENGINEERING PROGRAM
(Applicable for batches admitted from 2025-2026)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA



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R25 M.TECH MINING ENGINEERING SYLLABUS

COURSE STRUCTURE and SYLLABUS

M. Tech. – Semester I							
S. No.	Course Code	Course Title		L	T	P	C
1	MN101 (Core-1)	Advanced Rock Engineering		3	1	0	4
2	MN102 (Core-2)	Advanced Mine Planning and Design		3	1	0	4
	MN103 (Core-3)	Mine Health & Environmental Engineering		3	1	0	4
3	Program Elective – I MN 104	MN1041	Ground Control and Management	3	0	0	3
		MN1042	Tunneling and Underground Space Technology				
		MN1043	Rock Excavation Engineering				
		MN1044	Noise Pollution and Control				
4	Program Elective – II MN 105	MN1051	Instrumentation in Mining	3	0	0	3
		MN1052	Robotics & Automation in Mining				
		MN1053	Remote Sensing & Geographical Information Systems				
		MN1054	Mine Waste Management				
5	MN 106	Advanced Rock Engineering Lab		0	0	4	2
6	MN 107	Advanced Mine Planning and Design Lab		0	0	4	2
7	MN 108	Seminar I		0	0	2	1
Total				15	5	6	23



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M. Tech. – Semester II							
S. No.	Course Code	Course Title		L	T	P	C
1	MN 201 (Core-1)	Mine Safety Engineering		3	1	0	4
2	MN 202 (Core-2)	Mine Ventilation and Planning		3	1	0	4
	MN 203 (Core-3)	Advanced Mine Surveying		3	1	0	4
3	Program Elective– III MN 204	MN 2041	Surface Mine Environmental Engineering	3	0	0	3
		MN 2042	Quantitative Decision Making				
		MN 2043	Mining for Sustainable Development				
		MN 2044	Advanced Mining Methods				
4	Program Elective– IV MN 205	MN 2051	Geo- Statistics	3	0	0	3
		MN 2052	Advanced Underground Mine Planning and Design				
		MN 2053	Mine Slope Engineering				
		MN 2054	Introduction to Quantum Technologies				
5	MN 206	Advanced Mine Surveying Lab		0	0	4	2
6	MN 207	Mine Ventilation and Planning Lab		0	0	4	2
7	MN 208	Seminar II		0	0	2	1
Total				15	5	6	23

Note: Students are informed to complete Summer Internship (duration 8-10 weeks) at the end of the II Semester.

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M. Tech. – Semester III						
S. No	Course Code	Course Title	L	T	P	C
1		Research Methodology and IPR/Swayam 12 Week MOOC Course RM&IPR	3	0	0	3
2		Summer Internship/Industrial Training (8-10 Weeks)	-	-	-	3
3		Comprehensive Viva	-	-	-	2
4		Dissertation Part - A	-	-	20	10
TOTAL			3	-	20	18

M. Tech. – Semester IV						
S. No	Course Code	Course Title	L	T	P	C
1		Dissertation Part - B	-	-	32	16
TOTAL			-	-	32	16

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
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I Semester	ADVANCED ROCK ENGINEERING	L	T	P	C
		3	1	0	4

Course objectives:

1. To introduce fundamental concepts of stress
2. To develop the ability to design underground openings
3. To familiarize students with in-situ stress measurements
4. To enable learners to evaluate slope stability
5. To expose students to mine support systems,

UNIT I

Stress Analysis: Stress analysis in 2D and 3D, equations of equilibrium, Mohr's Circles, plane stress and plane strain condition, stress distribution in simple structures, Flexure of beams and rectangular plates

UNIT II

Design of Underground Openings, Subsidence, Rock Burst: Design of single and multiple underground openings, pillars including shaft pillar, scaling factors, Design of pillars including barrier and shaft pillars, mining subsidence, Monitoring and Prediction of subsidence, rock burst, Design of underground working under rock burst prone area,

UNIT III

In-Situ Stresses and Theories of Failure: In-situ stresses and instrumentation, drilling and blasting, measurement of stresses, strains, deformations, in-situ stress determination, strata monitoring in underground and opencast mines, mechanics of drilling and blasting, blast vibration and its monitoring. Different theories of rock failure and their applications in design of mining structures.

UNIT IV

Slope Stability: Types of failure, Factors affecting the failures, Design of slopes and spoil banks, slope stability in rock & soil and its analysis, slope monitoring and stabilisation techniques.

UNIT V

Mine support system: Design of Mine Supports-Conventional and non-conventional supports, supports in bord and pillar, room and pillar, longwall and other mining methods (Coal & Metal), Advanced support system.



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Text/Reference Books:

1. Obert, L. and Duvall, W.I., Rock Mechanics and Design of Structure in Rock John Wiley and Sons Inc., New York, 1967.
2. Vutukuri, V.S., and Lama, R.D., Handbook on Mechanical Properties of Rocks, Vol. I, II, III and IV, Transtech Publication, Berlin, 1974/78.
3. Peng, S.S., Ground Control, Wiley Interscience, New York, 1987.
4. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
5. Hoek, E., and Brown, S.T., Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980.

Course outcomes: Upon course completion, students should be able to:

1. Analyze 2D and 3D stress distributions
2. Design safe underground excavations and support systems
3. Evaluate and interpret in-situ stress measurements
4. Apply theories of rock failure
5. Critically assess and propose slope stabilization methods

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

I Semester	ADVANCED MINE PLANNING AND DESIGN	L	T	P	C
		3	1	0	4

Course Objectives: Students will be able to

1. Understand the methodologies and technical factors influencing both short-range and long-range mine planning.
2. Apply mine design principles in open-pit and underground mining to optimize production and safety.
3. Analyze mining layouts, equipment requirements, and drainage systems to improve operational efficiency.
4. Evaluate feasibility reports, project implementation strategies, and environmental management plans for mining operations.
5. Create comprehensive and optimized mine plans using modern mine planning software and simulation tools.

UNIT – I

Introduction: Technical factors in mine planning, methodology of mine planning, short range & long range, mine modelling, mine simulation systems approach to mine planning based on mine subsystem and their elements, mine plan generation.

UNIT – II

Open Pit Mining: Selection of initial mine cuts, location of surface structures, division of mining area into blocks, mine design, bench drainage, geometry, haul roads, slope stability; open pit limits and optimisation, calendar plan, production planning, production scheduling, economic productivity indices. Introduction to Mine planning softwares.

UNIT – III

Underground Mining: Location of mine entries, mine and auxiliary, optimisation of mine parameters, design of shaft pillars and protective pillars, planning of production capacity, layout of development drives / raises / winzes etc, length of faces, size of panels, etc, planning of support systems, ventilation, lay out of drainage system, planning production schedule and monitoring, selection of depillaring / stoping method, manpower management, economic/ productivity indices, techno economic analysis, mine reclamation design. Introduction to Mine planning softwares.

UNIT – IV

Equipment Planning: Latest technological developments in increase in both types and capacities of equipment used in mining operations. Planning and selection of equipment for different mining conditions. Equipment design for optimum drilling and blasting



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operations. Equipment information – performance, monitoring and expert systems. Innovative mining systems.

UNIT – V

Project Implementation and Monitoring: Pre-project activities – feasibility report, environment clearance, detailed project, report, sources of funds, import of technology, selection of contracts and contract administration, time management, cost control material management system, project quality assurance, social responsibility, government orders and guidelines. Environmental impact assessment and preparation of environmental management plan. Mine closure plan.

Text/ Reference Books:

1. Hustrulid, W. and Kuchta, M., (eds), Fundamentals of Open pit Mine Planning and Design, Elsevier, 1995.
2. Jayanth Bhattacharya, Principles of Mine Planning-Allied Publishers, Delhi 2003.
3. Ehrenburger, V and Fajkos, A., Mining Modelling, Elsevier, 1995.
4. Bawden, W.F., and Archibald., J.F., Innovative Mine Design for the 21st Century Elsevier,1993.
5. Passamehtoglu, A.G., Karpuz, C., Eskikaya, S. and Hizal, T., (Eds), Mine Planning and Equipment Selection, Elsevier, 1994.
6. Pazdziora, J., Design of Underground Hard Coal Mines, Elsevier, 1988.
7. Swilski, and Richards, Underground Hard Coal Mines, Elsevier, 1986.
8. Singh, B. and Pal Roy, P., Blasting in Underground excavations and mines, CMR Dhanbad, 1993.

Course outcomes: Upon completion of this course, students should be able to,

1. Describe the systems approach to mine planning and differentiate between short-term and long-term planning methodologies.
2. Design open-pit and underground mining layouts considering geotechnical, operational, and economic factors.
3. Select suitable equipment and technologies based on mining conditions and performance data.
4. Assess environmental, social, and economic aspects involved in mine project execution and closure planning.
5. Analyze mine production schedules, manpower planning, and support systems for both surface and underground operations.



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I Semester	MINE HEALTH & ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	1	0	4

Course objectives:

1. Understand the causes of mine accidents and the principles of hazard analysis, risk assessment, and safety management.
2. Analyze the economics of safety and occupational health issues, including ergonomics and behavioral safety in mining.
3. Evaluate the environmental impacts of mining activities such as land degradation, water and air pollution, and acid mine drainage.
4. Apply suitable pollution control, mine reclamation, and mine closure techniques to mitigate environmental damage.
5. Create comprehensive Environmental Management and Disaster Management Plans in accordance with relevant legislation and industry standards.

Unit I

Mine accidents, Accident analysis and prevention, Accident report, Risk assessment & preparation of safety management Plan. Safety audits. Occupational hazards in mines, Hazard analysis. Hazard control by engineering approach, Hazard control by system approach.

Unit II

Economics of safety and cost-effectiveness. Occupational health and safety, Occupational diseases, Problems of safety and health in contractual work, Behavior based safety, Ergonomics and its application in mining.

Unit III

Environmental problems due to mines and quarries. Land degradation. Pollution due to mining in terms of air and water. Acid Mine Drainage, Socio- economic impacts. Control measures.

Unit IV

Pollution due to noise and vibrations. Effluents discharge. Reclamation of mined out and subsided areas. Mine closure.



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Unit V

Environmental legislation and policies. Environmental Management Plan. Environmental Impact Assessment. Risk Analysis. Disaster management plan. Preparation of EMP for various mineral industries. Cost of environmental management. Environmental audit.

Text/Reference Books:

1. Ridley, J & Channing, J.; Safety at Work; Butterworth-Heinemann, Oxford, 2001.
2. L.C. Kaku: A Study of Mine management, Legislation & General Safety
3. S. Ghatak: A Study of Mine management, Legislation & General Safety
4. C.P. Singh: Occupational safety and health in Industries and mines
5. Dhar, B.B., Environmental Management of Mining Operations, Ashish Publication House, New Delhi, 1991.
6. Chadwick et al., Environmental Impacts of Coal Mining and Utilization, Pergamon Press, 1992.

Course outcomes: Upon completion of this course, students will be able to:

1. Explain the nature of mine-related hazards and outline the methods used for accident analysis, prevention, and risk management.
2. Apply ergonomic and behavior-based safety strategies to address occupational health and safety problems in mining environments.
3. Analyze the socio-economic and environmental impacts of mining operations and assess their long-term implications.
4. Evaluate noise, vibration, effluent, and pollution control measures, as well as mine reclamation and closure practices.
5. Develop Environmental Impact Assessments (EIA), Environmental Management Plans (EMP), and disaster management strategies for various mining projects.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
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I Semester	GROUND CONTROL AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

1. Understand the formation, classification, and properties of various soil types and the factors affecting ground alteration.
2. Apply different compaction techniques and quality control methods to improve soil density and strength for field conditions.
3. Analyze drainage and dewatering methods including design considerations for well points, pumps, and vertical drains.
4. Evaluate grouting and injection methods for soil stabilization and seepage control based on principles and material properties.
5. Create effective soil stabilization plans using mechanical, chemical, and reinforcement techniques including geosynthetics and admixtures.

UNIT – I

General : Formation of rock, soils and soil profiles, soil distribution in India and other countries - marine, black cotton soils (expansive), lateritic, alluvial, desert soils peat etc., factors affecting the alteration of ground after formation – natural and man-made – reclaimed soils – methods of geotechnical processes.

UNIT – II

Compaction methods: moisture density relations – compactive efforts – field methods – surface compaction, deep compactions- vigor compaction methods, vibro-probes, stone columns, sand compaction, stone column piles, selection of methods – quality control – specifications for compaction process for solving field problems.

UNIT – III

Drainage methods: seepage, ground water seepage control – filter requirements methods of dewatering – well point methods of discharge computations – design of steps for dewatering – design of well screens – selection of pumps and accessories – deep bored wells.

Precompression methods: compressibility and consolidation properties of soils estimation of rate of consolidation settlements – accelerating methods – monitoring compressions – design of vertical drains – consolidation by electro osmosis and vacuum compression methods.



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UNIT – IV

Grouting and injection methods: principles, design methods, selection of methods and requirements. Aspects of grouts, types of grouts and chemical applications, seepage control, solidification and stabilization – equipment and accessories used – quality control – specifications for achieving satisfactory results.

UNIT – V

Stabilization methods: mechanical, cement, lime, chemical methods of stabilization of soils – use of admixtures – polymers – geosynthesis – reinforcements thermal slurry trenches, void filling – prewetting – improving rock stability methods – exercise quality control to achieve desired results.

Text/Reference Books:

1. J.E. Bowles – Foundation Design & Analysis. McGraw-Hill Edition 1995.
2. Ground improvement techniques by P. Purushottam Raj, Laxmi Pub., 1999.
3. F. S. Fang Handbook of Foundation Engg. CBS Pub., 1985.

Course Outcomes: Upon completion of this course, students will be able to,

1. Describe the formation, distribution, and characteristics of different soil types and their behavior under natural and engineered conditions.
2. Select and implement appropriate compaction methods for various soil conditions and monitor their effectiveness in the field.
3. Design drainage and dewatering systems, including well points and vertical drains, for controlling groundwater and soil consolidation.
4. Assess different grouting and injection techniques for improving soil properties and controlling seepage in geotechnical projects.
5. Develop soil stabilization solutions using mechanical and chemical methods, including the use of polymers and geo-synthetic materials.



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I Semester	TUNNELING AND UNDERGROUND SPACE TECHNOLOGY (Programme Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the historical development, design principles, and behavior assessment of tunneling media for various underground applications.
2. Apply appropriate tunneling methods based on soil and rock characteristics, project requirements, and excavation challenges.
3. Analyze drilling and blasting operations including equipment selection, blast design, and performance evaluation in conventional tunneling.
4. Evaluate advanced mechanical excavation techniques such as road headers, impact hammers, and tunnel boring machines with respect to performance and limitations.
5. Create comprehensive tunnel support, surveying, and ground treatment plans that address adverse conditions and ensure safe tunnel operations.

UNIT I

Introduction: Historical developments, art of tunnelling, Assessment of behaviour of tunnelling media, deformation modulus and rock pressure assessment; Planning and design of tunnels for various purposes like road, rail, hydropower tunnels and caverns, Underground storage for LPG and crude oil, Nuclear waste disposal, determination of appropriate size and shape; Design of openings in rocks with the help of field data; Instrumentation and monitoring; Numerical modelling to assess the stability.

UNIT II

Tunnelling Methods: Types and purpose of tunnels; factors affecting choice of excavation techniques; soil and rock sampling and testing, Methods - soft ground tunnelling, hard rock tunnelling, shallow tunnelling, deep tunnelling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered and remedial measures.

UNIT III

Tunnelling by Drilling and Blasting: Unit operations in conventional tunnelling; Drilling - drilling principles, drilling equipment, drilling tools, drill selection, specific drilling, rock drillability factors; Blasting - explosives, initiators, blasting mechanics, blast holes nomenclature; types of cuts - fan, wedge and others; blast design, tunnel blast performance - powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.



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UNIT IV

Tunnelling by Road headers, Impact Hammers and Tunnel Boring Machines: Cutting principles, method of excavation, selection, performance, limitations and problems. Boring principles, method of excavation, selection, performance, limitations and problems; Road headers, Impact Hammers, Tunnel Boring Machines and applications.

UNIT V

Tunnel Surveying, Supports and Services: Surveying in Tunnels: Topographic and geological survey, Methods of surveying and different instruments used for surveying in tunnels, Supports in Tunnels: Principal types of supports, their design and applicability. Steel supports, rock bolts, shotcrete, wire mesh, chain link fabric and fibre reinforced shotcrete and other ground consolidation/grouting techniques. Ground Treatment in **Tunnelling:** Adverse ground conditions and its effect on tunnelling; introduction to ground control. Supports in Metro tunnels, **Tunnel Services and Hazards:** Ventilation, drainage and pumping. Explosion, flooding, chimney formation, squeezing ground.

Text/Reference Books:

1. Hudson, J.A., Rock Engineering Systems Theory and Practice, Ellis Horwood, England.
2. Clark G.B., (1987), Principles of Rock Fragmentation, John Wiley and Sons, New York.
3. Lohanson, John and Mathiesen, C.F., Modern trends in Tunnelling and Blast Design, AA Balkema, 154 P, 2000.
4. Bickel J.O., Kuesel T.R. and King E.H., Tunnel Engineering Hand Book, Chapman & Hill Inc., New York and CBS Publishers, New Delhi 2nd addition.

Course Outcomes: Upon completion of this course, students will be able to,

1. Explain the principles of tunnel design, rock pressure assessment, and instrumentation for monitoring tunnel stability.
2. Select suitable tunneling methods and excavation techniques for different ground conditions and project types.
3. Perform detailed drilling and blasting designs including choice of explosives, cut types, and muck handling strategies.
4. Assess the suitability and performance of mechanical excavation equipment including tunnel boring machines and road headers.
5. Design tunnel support systems and implement ground control measures while managing ventilation, drainage, and safety hazards.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
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I Semester	ROCK EXCAVATION ENGINEERING (Programme Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the physical, mechanical, and geotechnical properties of rocks and their influence on the selection of excavation methods.
2. Apply principles of drilling and evaluate drilling performance using key indices such as penetration rate and bit wear.
3. Analyze blasting mechanisms, design parameters, and safety aspects to optimize surface and underground blasting operations.
4. Evaluate rock cutting theories and select appropriate tools and machinery based on site-specific rock properties and excavation needs.
5. Create rock reinforcement designs and recommend advanced rock cutting techniques incorporating recent technological developments.

UNIT I

Introduction: Scope and importance of rock excavation engineering in mining and construction industries; physico mechanical and geotechnical properties of rocks vis-à-vis excavation method; selection of excavation method. Rock breaking processes: Primary, Secondary and Tertiary, Energy consumption computations

UNIT II

Drilling: Advances in drilling equipment, pneumatic versus hydraulic, design and operating parameters of surface and underground drilling; evaluation of drill performance (Penetration rate); DRI, Drill energy utilisation index, mechanism of bit wear; BWI and CLI, bit selection; economics of drilling

UNIT III

Blasting: Mechanism of rock breakage, presplitting, Blast hole pressure measurement, Explosives and their selection criteria (impedance matching); blast design for surface excavations and optimisation; blast initiation systems(timing design); blast performance evaluation; cast blasting; techno-economic and safety aspects of surface and underground blasting, Controlled blasting; advances in blast design for underground excavations: contour blasting; computer aided blast designs. Under water drilling and blasting

UNIT IV

Rock Cutting: Theories of rock tool interaction for surface excavation machinery - rippers, dozers, scrapers, BWE, continuous surface miners, auger drills; theories of rock tool



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interaction for underground excavation machinery ploughs, shearers, roadheaders, continuous miners and tunnel boring machines; selection criteria for cutting tools; Rock Stress, Site Investigation, Stress and strain in Rock, Strength and Swelling Behavior. Failure Criteria, Fragmentation and optimization.

UNIT V

Rock Reinforcement: Rock Support and Design, Case studies involving rock principles and their applications. Recent Developments in rock excavation machinery. Advanced rock cutting techniques; high pressure water jet assisted cutting, PCF, Specific energy computations; abrasive jets

Text/Reference Books:

1. Drilling and Blasting by C.L.Jimeno et al.
2. Rock Explosives Engineering by Holmberg, Persson and Lee
3. The Strength, Fracture, Workability of Coal, Evans and Pomeroy, Pergamon Press
4. Rock blasting operations by Sushil Bhandari
5. R. E. Goodman, Introduction to Rock Mechanics, John Wiley and Sons, 1980 , Indian edition available
6. Deb and Varma, Fundamentals and Applications of Rock MEchanics, PHP India
7. Franklin and Dusseault, Rock Engineering, Barnes and Noble
8. J. C. Jeager and N. G. W. Cook, Fundamentals of Rock Mechanics, Chapman and Hall, 1979.
9. Tunnel Boring Machines by N. Barton

Course Outcomes: Upon completion of this course, students will be able to,

1. Describe rock excavation principles and classify rock breaking processes for different mining and construction applications.
2. Calculate drilling performance metrics and recommend suitable drilling equipment and bits for various rock conditions.
3. Design blast patterns and initiation sequences optimizing rock breakage while ensuring safety and economic efficiency.
4. Assess cutting tool-rock interactions and determine optimal excavation machinery for surface and underground operations.
5. Develop rock support systems and apply advanced excavation techniques like high-pressure water jets and abrasive jets for improved efficiency.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
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I Semester	NOISE POLLUTION AND CONTROL (Programme Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the fundamentals of sound, frequency analysis, and noise measurement equipment.
2. Analyze the effects of noise exposure and community noise issues.
3. Apply techniques for environmental noise measurement and control of heavy earth moving machinery (HEMM).
4. Evaluate noise control measures in coal handling plants, jackhammer drills, and DG sets.
5. Create strategies for measurement and control of human vibration and assess its health impacts.

Unit 1

Basics of sound. Frequency analysis. Equipment's used for noise measurement. Various standards in India & abroad on noise exposure.

Unit 2

Effects of noise exposure. Community noise. Industrial noise control & hearing testing.

Unit 3

Environmental noise measurement. Noise measurement & control of HEMM.

Unit 4

Coal handling & preparation plants, Jackhammer drills. Noise control measures for DG sets.

Unit 5

Human vibration: measurement, control and standards. Health effect of vibration-Handarm and Whole-body vibration. Parameters influencing human response to vibration.

Text/Reference Books:

1. Harris, C.M: Handbook of Noise Control, McGraw- Hill Book Company, 1979.
2. Albert Thumann & Richard K. Miller: Secrets of Noise Control, The Fairmont Press, Georgia, 1976.
3. ISO 2631-1: Mechanical vibration and shock-Evaluation of human exposure to whole-body vibration-second edition 1997-05-01.



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Course Outcomes: Upon completion of this course, students will be able to,

1. Describe the principles of sound and frequency analysis along with noise exposure standards.
2. Explain the effects of noise on individuals and communities and methods of hearing testing.
3. Perform environmental noise assessments and apply noise control for HEMM.
4. Implement noise control solutions for coal handling, jackhammer drills, and DG sets.
5. Assess human vibration parameters, measure vibration exposure, and recommend control measures to reduce health risks.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
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I Semester	INSTRUMENTATION IN MINING (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand fundamental electrical instruments and their performance characteristics including accuracy and sensitivity.
2. Apply various pressure and flow measurement techniques using different types of gauges and flow meters.
3. Analyze vibration, humidity, velocity, and level measurement instruments and their working principles.
4. Evaluate different types of analyzers for dissolved gases and particulate matter, including calibration methods.
5. Create rock mechanics instrumentation solutions for stress, deformation, and seismic monitoring in mining applications.

UNIT I

Electrical Instruments: Basic Concepts: Sensitivity, range, reproducibility and accuracy, drift, absolute and relative measurements, error, environmental factors and planning for instrumentation. Accuracy, precision, resolution, sensitivity, linearity, span and range - Dynamic characteristics. Ammeters (MI & MC), Volt meters, Watt meters (Dynamometer), Energy Meters, Megger, Power Factor meters, Earth resistance measurement and thermocouples, Inclined meters

UNIT II

Pressure Measurements and Flow Measurements: Unit of Pressure – Manometers-Different types, - Elastic type pressure gauges and sensors– Bourdon tube – Bellows – Diaphragm – Elastic elements with LVDT and strain gauge, deformation gauge – Capacitive type pressure gauge – Measurement of vacuum – McLeod gauge – Thermal conductivity gauge – Ionisation gauge. Piezometer, Flow meters – Variable head type flow meter – Orifice plate – Venturi tube – Positive displacement flow meter: Nutating disc, Reciprocating piston, oval gear and helix type flow meter – Rotameter – Mass flow meters.

UNIT III

Vibration, Humidity, Velocity and Level Measurements: Mechanical type vibration measuring instruments – Seismic instruments as an accelerometer – Vibrometers – Geophones. Humidity – Hot wire electro type hygrometer – Dew cell – Electrolysis type hygrometer. Anemometer, Velometer, Pitot static tube, Sound level meter, microphone,



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Lux meter; Level measurements: – Float gauges - Displacer type – D/P methods -Bubbler system-Load cell – Electrical types – Conductivity sensors – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge – Boiler drum level measurement :- Differential pressure method and Hydrastep method -Solid level measurement.

UNIT IV

Analysers: Dissolved Analyzer: Conductivity meter – pH meter – Dissolved oxygen analyser – Sodium analyser – Silica analyser – Turbidity meter – Gas analyser – O₂, NO_x – H₂S analyser – CO and CO₂ monitor, Dust & Smoke measurement. IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Calibration methods.

UNIT V

Rock Mechanics Instrumentation: Different types of Load cells, stress capsules, Flat jack, tape extensor meters, convergence indicators and recorders, borehole deformation gauges of different types, depth indicators. Seismic measurements, Applications in Mining: Coal mining – bord and pillar development, depillaring and Longwall, Metal mining and opencast mining applications, rock slope instrumentation.

Text/Reference Books:

1. De, N.K. and Sen, P.K. 'Electric Drives' Prentice Hall of India Private Ltd, 2002.
2. Subramaniam, V. 'Electric Drives' Tata McGraw Hill , New Delhi,2007
3. Dubey, G.K. 'Fundamentals of Electrical Drives' Narosa, Second Edition.
4. Morris, A.S. Principles of Measurement and Instrumentation, Print ice-Hall of India Pvt., Ltd. New Delhi, 1999.
5. Doebelin, E.O. Measurement Systems Application & Design, Tata McGraw Hill Publishing Co., New. Delhi, 1999.

Course Outcomes: Upon completion of this course, students will be able to,

1. Describe the working and applications of electrical measuring instruments such as ammeters, voltmeters, and power factor meters.
2. Demonstrate the use of pressure and flow measurement devices including manometers, Bourdon tubes, and flow meters.
3. Explain the operation of instruments used for vibration, humidity, velocity, and level measurements.
4. Assess the functionality and calibration of various gas and dissolved analyzers for environmental and industrial monitoring.
5. Apply rock mechanics instrumentation techniques to monitor stress, deformation, and seismic activity in mining environments.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

I Semester	ROBOTICS & AUTOMATION IN MINING (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the fundamentals and components of industrial robotics including types of arms and end effectors.
2. Apply motion analysis and kinematic principles to robotic manipulators for solving forward and inverse kinematics problems.
3. Analyze differential transformations, Jacobians, and dynamics related to robotic manipulators and plan trajectories.
4. Evaluate various robot actuators and feedback sensors used in industrial automation.
5. Explore and apply robotics technologies and intelligent systems in mining operations and safety.

UNIT-I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications. Components of the Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, Design of end effectors, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

UNIT – II

Motion Analysis: Basic Rotation Matrices, Equivalent Axis and Angle, Euler Angles, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems. Manipulator Kinematics-H notation-H method of Assignment of frames-H Transformation Matrix, joint coordinates and world coordinates, Forward and inverse kinematics – problems on Industrial Robotic Manipulation.

UNIT – III

Differential transformation of manipulators, Jacobians – problems. Dynamics: Lagrange – Euler and Newton – Euler formations – Problems. Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint interpolated motion – straight line motion.



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UNIT – IV

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors.

UNIT – V

Robot Applications in Mining: Mining cycles such as drilling, blasting, loading, transportation in opencast mines; and its application in underground mining methods bord and pillar, blasting gallery, continuous miner and longwall, Mine ventilation: mine gas monitoring, ventilation survey and others. Rescue and recovery works. Application of IoT, AI, ML in Mining.

Text/ References Books:

1. Mikell PG, Mitchel W, Roger NN, Nicholas GO and Ashish D. Industrial Robotics: Technology, Programming and Applications. Pearson Edu.
2. Mittal R K and Nagrath I J. Robotics and Control. Tata McGraw-Hill Education Pvt. Ltd. 2003.
3. Richard DK, Thomas AC and Michael N. Robotic Engineering: An Integrated Approach. Prentice Hall. 1989.

Course Outcomes: Upon completion of this course, students will be able to,

1. Describe the architecture, degrees of freedom, and design considerations of industrial robotic systems.
2. Solve kinematic problems involving rotation matrices and frame transformations for robotic manipulators.
3. Calculate Jacobians and dynamic parameters for robot motion and develop trajectory planning strategies.
4. Compare and select appropriate actuators and sensors for robotic applications based on their characteristics.
5. Implement robotics and advanced technologies such as IoT, AI, and ML for enhancing mining processes and safety operations.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

I Semester	REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEMS (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the basic principles of remote sensing and electromagnetic radiation relevant to land cover analysis.
2. Identify different types of remote sensing sensors, platforms, and major satellite missions.
3. Apply digital image processing techniques for image interpretation, registration, and classification.
4. Comprehend the components, coordinate systems, and data handling methods in Geographic Information Systems (GIS).
5. Evaluate recent applications of RS, GIS, and GPS in environmental monitoring, mineral prospecting, and mining operations.

UNIT-I

Basic principles of Remote Sensing: Definition and components, Electro Magnetic Radiation; Wavelength regions of electro-magnetic radiation; Types of remote sensing with respect to wavelength regions; Black body radiation; Reflectance; spectral reflectance of land covers.

UNIT-II

Sensors and platforms: Types of sensors: Multispectral, Hyper-spectral, Microwave, scanners-along track and across track; Platform and their types-Geostationary and Polar orbiting, platforms based on altitudes. Satellite missions –MODIS, IRS, LANDSAT, SPOT, marine/ocean observation satellites.

UNIT-III

Digital Image Processing (DIP): Interpretation of Images; Registration: Transfer of Information from Imagery to Base Map; Classification; Exposure to various Image Processing Techniques and Generation of digitally processed outputs.

UNIT-IV

Geographical Information System (GIS): Definitions, History and development of GIS, components of GIS, applications of GIS; Coordinate Systems - Geographical Coordinate Systems, Projected Coordinate System, map projections; Geospatial data - Data input-existing GIS data, creating new data; attribute data query, spatial data query, raster data query.

UNIT – V

Applications: Recent trends in RS&GIS and Environmental assessment & monitoring, Land Use and Land cover classification, Vehicle tracking system, Application of Geo-statistical



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methods and GIS in mineral prospecting and ore reserve estimation, Applications of GPS in Mineral Resource Surveys, Mapping and Navigation. Role of DGPS surveys in mining leases and identifying illegalities.

Text / Reference books:

1. Anji Redddy M. Remote sensing and geographical information systems. 3rd edition. 2008.
2. Kaplan ED. Understanding GPS: principles and application. British Library Catalogue. 2006
3. Lillesand TM and Kiefer RW. Remote sensing and image interpretation. John Wiley and Sons, New York, 2004.
4. ML and Chouhan TS. Remote sensing and photogrammetry: principles and applications. Vigyan Prakashan, Jodhpur. 1998.

Course Outcomes: Upon completion of this course, students will be able to,

1. Explain the principles of remote sensing and spectral reflectance characteristics of various land covers.
2. Describe various sensors, satellite platforms, and their functionalities in remote sensing applications.
3. Demonstrate the use of digital image processing tools for analyzing and classifying remote sensing data.
4. Utilize GIS components and coordinate systems to perform spatial and attribute data queries.
5. Apply RS, GIS, and GPS technologies in practical scenarios like environmental assessment, mineral exploration, and mining survey management.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

I Semester	MINE WASTE MANAGEMENT (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the physical, chemical, and biological properties of mine wastes and their environmental hazards.
2. Analyze methods for mine waste disposal including slurry rheology and paste thickening techniques.
3. Evaluate tailings filtration processes, characteristics, and disposal methods for solid waste management.
4. Apply geo-mechanics principles to waste utilization, tailing pond design, and failure analysis.
5. Examine case studies on tailing dam failures and understand regulatory frameworks governing mine waste disposal.

UNIT I

Physical, chemical, and biological characteristics of mine wastes including waste rock, mineral processing wastes (tailings) and wastewater. Environmental hazards of waste generated in mining and mineral processing industries.

UNIT II

Mine waste disposal and rehabilitation approaches, Waste disposal in slurry form into tailing ponds. Principles of Slurry Rheology. Selection of pumps and type of pumps used for slurry transportation to tailing ponds. Paste thickening of tailings and disposal in the form of paste. Paste Characteristics & Rheology. Thickeners & pumps used for paste pumping.

UNIT III

Tailings filtration and disposal in solid form. Filtration processes and equipment. Characteristics of filtered tailings. Transportation and stacking issues of filtered tailings. Alternate use of mining waste by generating value added products.

UNIT IV

Current practices in mining waste utilization – Waste to Wealth concepts. Geomechanics principles in the disposal of mining and mineral processing waste (tailings). Tailing pond design & failure analysis.



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UNIT V

Case study: Tailing dam failures: Causes, impact on environment, society and businesses at large. Deficiencies of conventional mine waste disposal and rehabilitation approaches. National and International regulatory regimes pertaining to waste disposal in mining and mineral processing industries.

Text/Reference books:

1. Mine Wastes, Characterization, Treatment and Environmental Impacts, Bernd Lottermoser, 2010.
2. Mine Waste Management – California Mining Association, CRC Press; 1st edition (21 February 1992).
3. Mine Waste Management in China: Recent Development, Author - Di Wu, 2020
4. Mine Waste Utilization By Ram Chandar Karra, Gayana B C, Shubhananda Rao P, Published July 4, 2022 by CRC Press Copyright Year 2022.

Course Outcomes: Upon completion of this course, students will be able to,

1. Describe the characteristics and environmental impacts of various types of mine wastes.
2. Demonstrate knowledge of slurry and paste thickening processes and pump selection for tailings disposal.
3. Explain filtration techniques and management practices for solid tailings disposal and waste reutilization.
4. Assess geotechnical considerations in tailing pond design and analyze failure mechanisms.
5. Interpret real-world tailing dam failures and apply knowledge of regulations to improve mine waste management.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

I Semester	ADVANCED ROCK ENGINEERING LAB	L	T	P	C
		0	0	4	2

Course Objectives:

1. Analyze the properties of rocks and soils using various laboratory techniques.
2. Evaluate mechanical strengths such as compressive, tensile, and shear strengths of geological materials.
3. Apply standard test methods to determine physical and engineering parameters of rocks and soils.
4. Interpret experimental data to assess durability and hydraulic characteristics of geological specimens.
5. Develop skills to conduct and report geotechnical laboratory investigations effectively.

List of experiments:

1. Sample collection and Specimen preparation.
2. Determination of moisture content, density, voids ratio and porosity of rocks.
3. Determination of compressive strength, modulus of elasticity and Poisson's ratio of rocks.
4. Determination of tensile strength of rocks.
5. Determination of shear strength, angle of internal friction and cohesion of soil.
6. Determination of point load strength index of rocks.
7. Determination of protodyknov's strength index of rocks.
8. Determination of slake durability index of rocks.
9. Determination of cohesion and angle of internal friction of rocks using triaxial test.
10. Determination of hydraulic conductivity of sand.
11. Determination of Cerchar Abrasivity index.
12. Determination of drillability index of rocks

Course Outcomes: Upon completion of this lab course, students will be able to,

1. Demonstrate the ability to prepare specimens and collect samples accurately for geotechnical testing.
2. Calculate moisture content, density, porosity, and void ratios of rocks with precision.
3. Assess compressive, tensile, and shear strengths of rocks and soils through laboratory tests.
4. Interpret test results for strength indices and durability parameters to predict material behavior.
5. Design and perform standard laboratory procedures to evaluate hydraulic conductivity and abrasivity of geological materials.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

I Semester	ADVANCED MINE PLANNING AND DESIGN LAB (All the experiments should be performed using relevant software)	L	T	P	C
		0	0	4	2

Course Objectives:

1. Understand principles of reserve estimation for coal and metalliferous deposits.
2. Apply mining methods to design efficient underground and surface mine layouts.
3. Analyze and design ventilation systems for various mining methods.
4. Evaluate blasting designs considering safety and environmental constraints.
5. Develop comprehensive mine planning skills integrating dumps, slopes, and ventilation.

List of experiments:

1. Estimation of reserves of coal and metalliferous deposits.
2. Design of metal mine for sublevel stoping method.
3. Design of the surface mine layouts.
4. Design of underground coal mine for bord and pillar method.
5. Design of underground coal mine for longwall mining method.
6. Design of underground coal mine for continuous miner method.
7. Design of mine ventilation system for bord and pillar method.
8. Design of mine ventilation system for longwall panel.
9. Design of blast for open pit workings and in sensitive areas (Dwellings, public roads, archeological monuments, place of worship, railway lines, HT lines etc.)
10. Design of internal/external dumps for surface mine.
11. Design of ultimate pit slope for surface mines.
12. Design of ventilating system for metal mines.

Course Outcomes: Upon completion of this lab course, students will be able to,

1. Calculate reserves of coal and metalliferous deposits using estimation techniques.
2. Design underground and surface mines employing appropriate mining methods.
3. Develop ventilation system designs for underground coal and metal mines.
4. Formulate blast designs addressing safety in sensitive areas.
5. Create designs for dumps and ultimate pit slopes aligned with mine planning standards.



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I Semester	SEMINAR 1 (MN 108)	L	T	P	C
		0	0	2	1

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	MINE SAFETY ENGINEERING	L	T	P	C
		3	1	0	4

Course Objectives:

1. Analyze different types of mine accidents and investigate their causes using human behavioral approaches.
2. Understand the roles of management, labor organizations, and government in enforcing mine safety standards.
3. Apply advanced safety engineering techniques such as fault tree analysis and failure mode effect analysis.
4. Evaluate risk assessment methods and develop disaster management strategies for mining environments.
5. Examine miner's occupational health issues and implement preventive measures based on inquiry committee recommendations.

UNIT I

Mine accidents and their analysis: Accident in mines;- different types, accident investigations; In-depth study of accidents due to various causes; and Human Behavioural Approach in mine safety, accident prevention and corrective action, accident proneness, creating and maintaining safety awareness, ZAP and MAP, job safety analysis, safety meeting and committee.

UNIT II

Mine safety: Definition of safety, management's role – function; evolution of management involvement, management's training, responsibility, cost of safety, role of labour organizations – Union impact and involvement, role of government – statutory controls and directions, spot and regular inspections, enforcement of standards, penalties for violations, collection and distribution of statistical data. Safety audit methods; Safety records management, Training of Miners. Recent trends of development of safety engineering approaches.

UNIT III

Fault tree analysis: Introduction – methodology, symbols and Boolean techniques, qualitative analysis, computerized methods, statistical analysis, safety information, systems design. Appraisal of advance Techniques - fault tree analysis, Failure–Statistical methods of Risk analysis: Appraisal of advanced techniques Mode and Effect Analysis (FMEA); Failure Mode Effect and Critical Analysis (FMECA)



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UNIT IV

Risk assessment and disaster management: Principles, risk and hazard control, risk and hazard evaluation and data collection for identified health risks, exposure assessment and risk characterization, probabilistic risk analysis, risk management, safety culture, human factors, reliability evaluation, safety audit. Identification of causes of mine disasters, preventive action.

Concepts of Disaster, Types of Disaster and Dimensions of Natural and Anthropogenic Disasters (landslide, subsidence, fire and earthquake); Principles and Components of Disaster Management. Disaster Management and Mitigation, typical cases of mine disasters in India.

UNIT V

Miner's occupational diseases and enquiry committee: Miner's occupational health and diseases, preventive medical examinations, various types of injuries, compensable diseases, medical attention and removable of causative factors in the mines. Recommendations of inquiry committee carried out for safety and health issues in India, Compensation for effected people.

Text / Reference books:

1. Brown DB. System analysis and design for safety. Prentice Hall. 1976.
2. Stranks J. Management systems for safety. Pitman publishing. 1994.
3. DeReamer R. Modern safety practices. John Wiley and Sons. 1959.
4. Wahab KA. New technology in health and safety. SMME. 1992.
5. Ericson CA. Fault tree analysis primer. Create Space Independent Publishing Platform. 2011.

Course Outcomes: Upon completion of this course, students will be able to,

1. Differentiate types of mine accidents and conduct thorough accident investigations.
2. Illustrate management's and labor organizations' responsibilities in mine safety enforcement.
3. Perform fault tree analysis and apply statistical methods for risk analysis in mines.
4. Assess hazards, implement risk control measures, and formulate disaster management plans.
5. Identify occupational diseases in miners and recommend preventive health and safety actions.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	MINE VENTILATION AND PLANNING	L	T	P	C
		3	1	0	4

Course Objectives:

1. Understand the origin, properties, and detection methods of mine gases.
2. Analyze mine climate factors and their impact on miner health and safety.
3. Apply principles and laws governing natural ventilation in mines.
4. Evaluate mechanical ventilation systems, including fan selection and network analysis.
5. Develop ventilation plans tailored to different mining methods and standards.

UNIT-I

Mine Gases: Origin, occurrence, physical, chemical and physiological properties of mine gases, instruments used for spot detection of mine gases. Various damp, methane drainage techniques. Gas chromatography.

UNIT-II

Mine Climate and Control: Sources of heat and humidity in mines and their effects, instruments used for measurement of temperature, humidity, pressure and velocity. Heat stress indices, Cooling power and method of improving cooling power.

UNIT-III

Natural Ventilation and Laws of Air flow: Natural ventilation, Factors effecting NVP, Direction of air flow, Derivation of NVP, Motive column, Atkinson law governing airflow in mine openings.

UNIT-IV

Mechanical Ventilation: Definition of Mechanical ventilation, Different types of fans and their characteristics, Operating point, Fan laws, installation. Ventilation appliances, economic size of roadways, determination of quantity and head requirements. Fan selection and evasee.

Ventilation networks: simple and complex, solutions to simple ventilation network. Introduction to Hardy cross method for solving complex network. Introduction to ventilation softwares.



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UNIT-V

Ventilation Planning: Standards of ventilation, ascensional ventilation, descensional ventilation, ventilation planning for different mining methods: Bord and pillar, Longwall mining method and cut and fill, sub level caving and shrinkage stoping method.

Text / Reference books:

1. Mishra GB. Mine environment and ventilation. Oxford University Press. 1992.
2. Hartman HL. Mine ventilation and air conditioning. Wiley Interscience publication.1993.
3. Hall CJ. Mine ventilation engineering. Society of mining engineers, New engineers, New York, 2nd Edition. 1992.
4. Vutukuri VS. Mine environment engineering, Trans tech publishers. 1986.
5. McPherson MJ. Subsurface ventilation and environmental engineering. Chapman and hall publication, London. 1993.

Course Outcomes: Upon completion of this course, students will be able to,

1. Identify and explain the characteristics and detection techniques of various mine gases.
2. Measure and assess mine climatic conditions using appropriate instruments.
3. Calculate natural ventilation parameters using Atkinson's law and related principles.
4. Design mechanical ventilation systems and solve ventilation network problems.
5. Formulate ventilation plans for different mining methods following regulatory standards.



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R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	ADVANCED MINE SURVEYING (MN 203)	L	T	P	C
		3	1	0	4

Course Objectives:

1. Understand principles of remote sensing, photogrammetry, and GIS applications in mining.
2. Apply advanced surveying instrumentation techniques including GPS, DGPS, and total stations.
3. Analyze underground surveying methods and correlate measurements in shafts and stopes.
4. Design and execute opencast surveying tasks such as slope monitoring and volume calculations.
5. Comprehend national grid systems, map projections, and geodetic concepts relevant to mining surveys.

UNIT I

Remote sensing Remote sensing, Photogrammetry, satellite imaging, GIS application to mining, Computer aided drawings of plans and section.

UNIT II

Advances in Surveying Instrumentation GPS & DGPS, Principle, operation, application to mine survey and face monitoring. Laser profilers, EDM, Total Station, principle, techniques and application in mines.

UNIT III

Underground Surveying Methods of correlation - direct traversing in inclined shaft, correlation in vertical, single and two shafts. Gyro-theodolite & its application. Stope Surveying: Purpose, methods of survey in moderately and steeply inclined ore bodies, flat and vertical ore bodies/seams. Relevant provisions and requirements as per the Regulations. Subsidence survey.

UNIT IV

Opencast surveying Slope monitoring Survey, Bench & Ramp Layout survey, Joint boundary survey, Problems based on Dip-Strike, boreholes, faults, Area and Volume calculations. Relevant provisions and requirements as per the Regulations.



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UNIT V

National Grid: Map Projections; Cassini, Lambert's Polyconic, UTM, transformation of coordinates. Geodesy: Geoid, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Text/Reference Books:

1. Ghatak, S., Mine Surveying and Levelling – Vol I, II & III, Coal Field Publishers, Asansol, 2005
2. Punmia, B. C., Surveying Vol- I & II, Laxmi Publishers, New Delhi, 2008.
3. Kanetkar, T.P., Surveying, Vol- I & II, Tata McGraw Hill, New Delhi, 2007
4. Fundamentals of Remote Sensing, by George Joseph & C. Jeganathan, 3rd Edition
5. Advanced Surveying: Total Station, GPS, GIS & Remote Sensing by Pearson, by Gopi Satheesh, R. Sathikumar, N. Madhu, 2 nd Edition

Course Outcomes:

1. Demonstrate the use of remote sensing and GIS tools for mining survey and planning.
2. Operate modern surveying instruments and interpret their data for mine monitoring.
3. Perform underground survey correlation and stope surveying adhering to regulations.
4. Calculate dimensions and layouts for opencast mining operations with accuracy.
5. Transform coordinates and apply geodesy principles to mining survey data.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	SURFACE MINE ENVIRONMENTAL ENGINEERING (Programme Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Remember - Recall environmental management principles and policies.
2. Understand - Explain environmental pollution sources and effects.
3. Apply - Implement environmental management plans and standards.
4. Analyze - Assess environmental impact and develop mitigation strategies.
5. Evaluate - Determine effectiveness of environmental legislations.

UNIT I

Introduction: Goals, strategies and tools for environmental management – systems approach to environmental management – environmental guideline – National Policies on environment with respects to mining activities – Global and Local environmental issues – resource degradation – desertification – Industrialization, Objectives of Sustainable Development. Structure of the atmosphere – ozone layer depletion – Acid rain – Green house gases and global warming Ambient Air quality and emission standards, Air quality Sampling and monitoring, Dispersion of air pollutants.

UNIT II

Environmental Pollution: Environmental Pollutants due to surface – Air, Water, Noise, Sources and Classification of pollutants including dust and their effect on human health, Sources, hazards, sampling and analysis, standards, instrumentation and measurement of pollutants including dust, Air born dust modelling, Control and preventive measures for air pollution including for dust, Water pollution standards, Impact of pollution on human health, miner’s diseases and their social impact.

UNIT III

Noise pollution and land degradation: Noise standards – Measurement – Noise Impact Index assessment, Control and preventive measures for water, noise pollution. Pollution due to blast and equipment vibrations their monitoring, prevention and control.

Land pollution, land for alternation dealing with mind out land, re-vegetation, tailing management, tailing dams, method and construction, land use plan, Textural classification and properties of soil.



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UNIT IV

Environmental Management: Environmental quality objectives, Emission and ambient standards – Minimum National standards – International environmental standards – ISO 14000 – EIA Notification – Siting of Industries – Environmental management plans, Environmental impact assessment, Environmental management system audits, Environmental economics – Principles of cost benefit analysis – Valuing the Environment – Environmental Accounting, Environmental administration- training awareness and competence, Mine subsidence, its prediction and control.

UNIT V

Environmental Legislations: Environmental laws, the Environmental (Protective) Act, 2004, The Water Act (1974), The Air act (1981), The Forest Act 1927, The forest conservation act 1980, Power and responsibilities of regulatory agencies and occupation consent to establish and operate wild life protection act and rules, Environmental clearance procedure for a mining Project, Mine closure planning.

Text/Reference Books:

1. Manahan S.E. Environmental Science and Technology.
2. Mackenthun, K.M. Basic Concepts in Environmental Management, Lewis Publications, London, 1998.
3. Noel de Nevers, Air Pollution Control Engg., McGraw Hill, New York, 1995
4. Anjaneyulu, Y. Air Pollution & Control Technologies, Allied Publishers (P) Ltd, India, 2002.
5. Nick Hanley, Jaison F. Shogren and Ben White. Environmental Economics – In Theory and Practice, Macmillan India Ltd, New Delhi, 1999.
6. Roger Perman, Yue Ma and James McGilvray. Natural Resources and Environmental Economics, Second edition, Addison Wesley Longman Ltd, Singapore, 1997.

Course Outcomes: Upon completion of this course, students will be able to,

1. Identify key environmental legislations and regulations.
2. Describe environmental pollution types and effects.
3. Conduct environmental impact assessments and audits.
4. Interpret data on environmental pollution and management.
5. Develop strategies for sustainable environmental management.

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R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	QUANTITATIVE DECISION MAKING (Programme Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the fundamental concepts of systems engineering, operations research, and modeling tools used in systems analysis.
2. Apply linear programming techniques to solve mining-related problems such as production planning and scheduling
3. Analyze transportation and assignment models and demonstrate their applications in mining scenarios.
4. Evaluate network analysis tools like PERT and CPM, and queuing theory models relevant to mining operations.
5. Develop simulation models for mining systems and apply decision-making tools in mineral industry applications.

UNIT I

Introduction: Introduction to systems engineering, systems concept and analysis, models in systems analysis, tools and methodology of system analysis.

Operations Research: Introduction to operations research, introduction to linear programming, application to mineral industry.

UNIT II

Linear Programming: Linear Programming models; Assumption of linear programming, Graphical and Simple method of solving Linear Programming Problems, Application of Linear Programming for solution of mining related problems of production planning, scheduling and blending.

UNIT III

Transportation and Assignment Problem Transportation models, Variations on Classical Transportation models, Solution; Algorithm for Transportation problem. Assignment model, Variations on Assignment model. Solution algorithm for Assignment problems. Application to mining problems.

UNIT IV

Network Analysis: PERT & CPM Assumption of PERT and CPM; Methods of drawing network; Redundancy; Critical path calculation; Statistics related to PERT; Case studies.



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R25 M.TECH MINING ENGINEERING SYLLABUS

Queuing Theory & Probability Introduction and concept; Review of probability, random variables, distributions, generating functions, Characteristics of queuing systems, Markovian and non-Markovian queuing system, Scope, applications and limitation

UNIT V

Simulation Techniques: Introduction to Monte-Carlo sampling and deterministic simulation of different mining subsystems and total system, simulation application for equipment selection and production scheduling.

Miscellaneous: Inventory of mineral resources, basic models and optimisation, introduction to statistical decision theory and its application in mineral industry.

Text/Reference Books:

1. Linear Programming by G. Hadley, Narosa, Reprint, 2002
2. Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010
3. Operations Research- Principles and Practice by A. Ravindran, D. T. Phillips and James J. Solberg., John Wiley & Sons, 2005.
4. Introduction to Operations Research- Concepts and Cases by F.S. Hillier. G.J. Lieberman, 9th Edition, Tata Mc-Graw Hill, 2010.
5. Syal, I.C., and Gupta, B.P., Computer Programming and Engineering Analysis, A.B., Wheeler and Company, Madras 1986.
6. Anon., Management by Network Analysis, The Institution of Engineers (India), 1976.
7. Cummings, A.B., and Given I.V. SME Mining Engg., Handbook Vol I and II, SME-41 ME, Inc, New York, 1973.

Course Outcomes: Upon completion of this course, students will be able to,

1. Explain key principles of systems engineering and operations research in the context of mining systems
2. Solve linear programming problems using graphical and simplex methods for mining applications
3. Analyze and solve transportation and assignment problems in mining operations.
4. Evaluate network models (PERT/CPM) and queuing systems to optimize mining processes
5. Design and simulate mining subsystems using Monte Carlo and deterministic methods.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	MINING FOR SUSTAINABLE DEVELOPMENT (Programme Elective I)	L	T	P	C
		3	0	0	3

Course objectives:

1. Understand the principles and legislative frameworks guiding sustainable development in the mining industry.
2. Analyze the impact of current mining practices and national policies on sustainability goals.
3. Apply clean technologies and recycling methods to promote sustainable mineral development.
4. Evaluate environmental challenges in mining related to water, air, and waste, and their control measures.
5. Create innovative and sustainable solutions for mine closure, land reclamation, and community development.

UNIT-I

Concept of Sustainable development for mining industry-Sustainable development –a perspective of mineral professional community. International sustainability reporting and tools for measurement of sustainability. Milos statement on Sustainable mineral industry. Legislative measures for sustainable development- MMRD Act- star rating of Indian mines (Non-coal), Environmental responsibility – Corporate social responsibility. District mineral fund, its collection, utilization etc.

UNIT-II

Current status of mining practices and their impact on sustainability. Mining and environmental frame work, National mineral policies in mineral based countries. Indian national mineral policy, its historical development with the changing goals and sustainable practices. Issues of leases, auctions for mineral development in India.

UNIT-III

Clean coal technologies, Coal bed methane, abandoned coal mine methane, Underground gasification of coal. Leaching of old dumps and recovery of metals. Recycling of metals. Application of new techniques for sustainable development.



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UNIT-IV

Mine water- Water Conservation Acts and rules in India. New Initiatives in mines. Underground mine water, Water pollution and control measures, Phyto-remediation, Sewage and effluent treatment plants, their use and benefits. Waste management-processing of overburden material for underground stowing and innovative methods for utilization of waste from mines.

Air quality in open pit mines, dust control measures, noise levels- pollution, monitoring and control.

UNIT-V

Best mining practices for Sustainable mining- Case studies, Innovative practices for achievement of sustainability. Benefits of sustainability. Bio-diversity- Land reclamation and plantation. Mine closure plan- Collection and disbursement of Mine closure fund for both open pit and underground mines in India. Restoration of closed mines for community services like tourism, water sports, parks, power generation etc.

Text/Reference Books:

1. MMRD Act 2015 and amendments, Ministry of Mines
2. Mineral concession Rules
3. Guidelines of MOEF and Climate change,- Annual reports of MOEF&CC, Ministry of Mines, Ministry of Coal in India,
4. Sustainable mining practices –A global perspective by Vasudevan Rajaram, Subijoy Dutta, Krishna Pareswarar,ISBN-90-5809-689-0

Course outcomes: Upon completion of this course, students will be able to,

1. Explain the concept of sustainable development and its relevance to mining activities.
2. Analyze the historical and current policies influencing sustainable mining practices in India.
3. Apply clean coal technologies and metal recycling techniques to enhance sustainability.
4. Assess pollution control measures related to water, air, and noise in mining operations.
5. Design sustainable mine closure and biodiversity restoration plans with community benefits.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	ADVANCED MINING METHODS (Programme Elective I)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To impart knowledge of advanced methods for mining thick, steep, and thin seams with emphasis on mechanized and safe extraction techniques.
2. To familiarize students with infrastructure and technologies used in high-capacity underground coal mining operations.
3. To develop understanding of stope design, planning, and execution for underground metal mining methods.
4. To introduce concepts, technologies, and legal frameworks involved in deep sea mining and its potential in India and globally.
5. To provide insights into placer and borehole mining methods including environmental, geotechnical, and mineral processing aspects.

Unit I

Mining of thick and steep seams: Problems of mining thick seams; Longwall based multi-slice methods:- Inclined slicing, horizontal slicing and cross-slicing in ascending and descending sequence Under winning methods:- sub-level caving, integral caving, Longwall Top Coal Caving.

Mining of thin seams: Problems in Mining thin seams; Equipment and methods for thin seam extraction.

Unit II

Infrastructure for Underground Mass Production Technologies: Features of high capacity, underground coal mining equipment, High Capacity Hoisting / Conveying of coal; Mass inertization plant; Pre-drainage of methane; Conveyance of man; Heavy material handling – Multi-utility vehicle, Air Chilling Plant, Case studies of high capacity underground coal mines.

Hydraulic Mining of Coal: Conditions suitable for hydraulic Mining of Coal, Hydraulic Mining Operation; Layout of workings for hydraulic mining of moderately thick seams.

Unit III

Planning, design and execution of different underground stopes for production: General excavation design in mines, Design method of different stopes, input parameter for stope design, geological, rock mass, geo technical consideration, economic consideration, environmental considerations, safety considerations, logistic parameters, Sequence of stope development and peroration, stope layout, optimization of stope



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operation, development of complex method for achieving higher return, design of stope ventilation.

Open Room & Pillar, Shrinkage, Cut - fill, Sublevel Caving, Sublevel stoping, Block Caving, Top Slicing, Resuing, Rill Stope, Vertical Crater Retreat Method, Squire Set Method,

Unit IV

Deep Sea Mining: Introduction and value chain, Mining Potential: Reserves and Life (Global and Indian), Legal Framework for deep sea and placer mining, Advances in deep sea mining: Methodologies for resource potential assessment, 3D modelling, strategic mine planning and mining systems, Hyperbaric cutting of rock, Vertical hydraulic transport of solid particles, Processing of marine minerals, Applied mineralogy and its link to mineral processing with special reference to marine minerals, Underwater Robotics.

Unit V

Placer Mining: Introduction, Industrial Applications, Mining Methods, Geological processes, Exploration, Introduction, Need and Importance, Port deepening and Widening, Geotechnical characterization, Mechanical cutting using drum cutters, Processing: Methods for $\frac{3}{4}$ metal extraction for deep sea minerals, Mineral Separation Plant, Tailing Disposal, Land Reclamation and Rehabilitation for beach placers, Environmental impacts and control measures for deep sea and placer mining. Principles, process and applications of highwall mining, borehole mining.

Text/Reference Books:

1. Modern Coal Mining Technology by S.K. Das
2. Rock Mechanics Applied to Mining and Civil Engineering, Z.T.Bieniawsky
3. Underground Excavation of Rocks : Hoek and Brown
4. Introductory Mining Engineering by Howard L. Hartman & Jan M. Mutmansky
5. Surface Mining by B.A. Kennedy
6. Elements of Mining Technology, Vol. III by D.J. Deshmukh
7. Handbook of Placer Mineral Deposits, G. Victor Rajamanickam, New Academic Publishers,
2001 - Placer deposits

Reference Books

1. Handbook of Marine Mineral Deposits, Edited By David Spencer Cronan
2. The Indian Ocean Nodule Field, 2nd Edition: Geology and Resource Potential, Authors:R.
Mukhopadhyay Anil Kumar Ghosh Sridhar Iyer
3. Ocean Floor Mining (Ocean Technology Review), December 1975, by John S. Pearson



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4. Comprehensive Rock Engineering Ed. by J.Hudson
5. Tunneling and Underground Space Technology Journal
6. SME Mining Engineering Handbook (Latest Edition), SME
7. Highwall Mining – SME Transactions and Conference Papers (edited by R.T. Przybylowicz and others)
8. Surface Mining Technology by S.K. Das
9. Deep-Sea Mining: Resource Potential, Technical and Environmental Considerations, Editors:
Sharma, Rahul (Ed.)
10. Deep Sea Mining and the Law of the Sea by Alexandra Merle Post
11. Deep Marine Mineral Resources: Editors: Fouquet, Yves, Lacroix, Denis (Eds.)
12. Planning, design and construction of tunnels: B.N.Whittaker & C.Frith

Course Outcomes:

1. Students will be able to analyze and compare various thick and thin seam mining methods and select appropriate techniques.
2. Students will demonstrate understanding of equipment, infrastructure, and planning required for high-capacity underground mining.
3. Students will be capable of designing, planning, and optimizing stopes considering geological and economic factors.
4. Students will gain knowledge of modern deep sea mining technologies and evaluate their feasibility and impact.
5. Students will be able to explain and apply techniques of placer and borehole mining, including environmental and processing considerations.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	GEO STATISTICS (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the fundamental concepts, stages, and strategies involved in mineral exploration.
2. Analyze classical statistical distributions and their application in mineral resource evaluation.
3. Apply geostatistical tools such as semi-variograms and Kriging for resource estimation.
4. Evaluate advanced geostatistical challenges including anisotropy, non-stationarity, and nugget effect.
5. Develop geostatistical models for optimization of drilling, mineral inventory, and grade control.

UNIT - I

Introduction to mineral exploration: Significance and necessity; Prospecting and exploration criteria; Exploration strategy and design - stages of mineral exploration; theory and methods of sampling; resources and reserves - terminology and classification schemes; conventional methods of ore estimation.

UNIT - II

Classical statistical distributions: normal and lognormal, and their applications in resource evaluation. Definition of geostatistics, schools of thought; stationarity assumptions and regionalized variables; what, when and why of Geostatistics.

UNIT - III

Semi-variogram and co-variogram: definitions, characteristics, and computations in one, two and three dimensions; mathematical models; associated difficulties viz. anisotropy, non-stationarities, regularization, presence of nugget effect and presence of trend. Extension, estimation and dispersion variance; calculation by discretization and auxiliary functions.

Kriging: definition and derivation of Kriging system of equations. Practice of semi-variogram modeling; practice of Kriging - steps and procedure. An introduction to advanced Geostatistics.

UNIT - IV



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Advanced Geostatistics: Practical difficulties associated with semi-variography, viz. anisotropy, non-stationarity, regularisation, misclassified tonnage; grade control plan. presence of nugget effect and presence of trend. Extension, Estimation and Dispersion variances: definitions, methods of calculations and applications; Screen Effect.

UNIT - V

Geostatistical applications: optimization of exploration drilling; calculation of mineral inventory; establishment of grade-tonnage relations; misclassified tonnage; grade control plan. Geostatistical conditional simulation - theory and approach. Geostatistical case studies of selected mineral deposits.

Text/Reference books:

1. Sarma DD. Geo statistics with applications in earth sciences. Springer publications. 2009.
2. Journel AG and Huijbregts C J. Mining geo statistics. Academic press. 1981.
3. Andereson F. Geo statistics by example approach using R. 2006

Course Outcomes: Upon completion of this course, students will be able to,

1. Explain the principles of mineral exploration, sampling methods, and ore estimation techniques.
2. Apply statistical and geostatistical methods to assess mineral resources.
3. Compute and model semi-variograms and perform Kriging for spatial estimation.
4. Analyze and address challenges in advanced geo-statistics related to variability and uncertainty.
5. Design geostatistical solutions for drilling optimization, grade-tonnage relations, and resource classification.



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II Semester	ADVANCED UNDERGROUND MINE PLANNING AND DESIGN	L	T	P	C
	(Programme Elective II)	3	0	0	3

Course Objectives:

1. Understand the fundamentals of mine planning, reserve estimation, and various mining project reports.
2. Analyze underground coal mining methods and factors influencing their selection.
3. Apply design principles to underground coal mine workings including panel and pillar layouts.
4. Evaluate underground metal mining methods based on technical, economic, and environmental factors.
5. Design safe and efficient underground mining systems for metal deposits using innovative and conventional techniques.

UNIT - I

Introduction: Exploration, resource, reserve, grade, thickness and size of the deposit, the various reserve estimation techniques. Characteristics of planning process, scope of mining activities, stages of mine planning, feasibility report, detailed project report, mining plan, mine closure plan, mine environmental plan and other plans.

UNIT – II

Underground coal mining methods: Classification of methods of mining coal; factors governing choice of coal mining methods. The various underground coal mining techniques: bord and pillar, blasting gallery, continuous miner, longwall and other special techniques. Criteria for selection of different mining equipment.

UNIT – III

Design of underground workings in coal mines: Pillar mining systems: design of panels, rooms and pillars; design and methods of pillar extraction with bord and pillar, blasting gallery and longwall mining; methods and design considerations for exploitation of thick seams by inclined slicing, horizontal slicing and cross-inclined slicing methods; sub-level caving and integrated caving methods. Design and methods of exploitation of contiguous seams, exploitation of seams under water bodies and seams liable to bumps. Design and method of underground hydraulic mining. Underground gassification of coal.



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UNIT - IV

Underground metal mining methods: Classification of exploitation methods; choice of mining systems - geomechanical, techno-economical, environmental and safety considerations. Factors governing the choice of methods. The different underground stoping methods: breast stoping, under hand and overhand, room and pillar, sublevel, square set, shrinkage, cut and fill methods and other stoping methods.

UNIT – V

Design of underground workings in metal mines: General engineering design; design methods in mining; input parameter for design - geological and other rock mass parameters; empirical, observational and analytical methods of design; design of excavations in massive elastic, stratified and jointed rocks.

Design of stoping layouts for mining of different types of ore deposits. Unit operations of stoping. Mining in rockburst prone areas. Novel and innovative mining methods: hydraulic, thermal, hydrochemical and biochemical methods; marine mining and nuclear device mining systems.

Text/Reference books:

1. Mathur SP. Mine planning for coal. M G Consultants, Bilaspur. 1993.
2. Bhattacharya J. Principles of mine planning. Allied Publishers Pvt Limited, New Delhi. 2003.
3. Hustrulid W and Kuchta M. Open Pit Mine Planning and Design. A A Balkema Rotterdam. 1995.
4. Vorobjev BM and Desmukh RT. Advanced coal mining vol-II. Asia Publishing house, Bombay, revised edition. 1966.
5. R. D. Singh, “Principles and Practices of Modern Coal Mining,” New Age International (P) Ltd., New Delhi, 1997.

Course Outcomes: Upon completion of this course, students will be able to,

1. Explain the stages of mine planning and different reserve estimation techniques.
2. Compare various underground coal mining methods and select appropriate techniques based on site conditions.
3. Design underground coal mine layouts for different seam conditions and extraction methods.
4. Analyze and select suitable stoping methods for underground metal mining based on deposit characteristics.
5. Design underground workings and stoping layouts for metal mines using empirical, analytical, and innovative approaches.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	MINE SLOPE ENGINEERING (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the fundamental mechanics and design principles related to rock slope stability.
2. Analyze geological and mechanical properties of rock masses affecting slope behavior.
3. Apply analytical methods to assess plane and wedge failures in rock slopes.
4. Evaluate circular and toppling failure conditions using limit equilibrium techniques.
5. Develop monitoring and stabilization strategies for rock slopes in opencast mining.

Unit I

Basic Mechanics of Rock Slope Failure: Rock Slope Geometry, slope stability, factor of safety of slopes. Causes of rock falls. Slope height vs slope angle; design of slope economics. Ground water flow in rock masses; field measurement of permeability; measurement of water pressure.

Unit II

Geological and Rock Strength Properties: Geological parameters & physico-mechanical properties affecting slope stability, graphical representation of geological data; plotting and analysis of field measurements; determination of shear strength of rock and rock discontinuities

Unit III

Plane Failure and Wedge Failure: Conditions for Plane Failure and Wedge failure. Plane failure analysis; graphical analysis of stability; influence of ground water & tension crack on stability; analysis of failure on a rough plane; rock reinforcement of slopes; Analysis of wedge failure; wedge analysis including cohesion and water pressure; Numerical problems

Unit IV

Circular and Toppling Failure: Conditions for Circular & Toppling failure; circular failure analysis; effect of ground water; Bishop's and Janbu's methods of failure analysis. Types of toppling failure; analysis of toppling failure; limit equilibrium analysis of toppling failures; Numerical problems.



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Unit V

Rock Slope Monitoring and Slope Stabilization: Strata monitoring in opencast mines. Surface and Sub-surface monitoring methods in opencast mines including instrumentation and techniques. Guidelines for monitoring programs. Rock slope stabilization programs – stabilization by rock reinforcement & rock removal; Protection of slopes; control of rock falls; measurement and monitoring and interpretation of slope displacements.

Text/Reference Books:

1. Duncan C.Wylie and Chris Mah, Rock Slope Engineering, 4th Edition, 4th Edition, CRC Press,456p, 2004.
2. John Read and Peter Stacey, Guidelines for Open Pit Slope Design, 1st Edition, CRC Press,510p, 2009.
3. William A. Hustrulid (Ed), Michael K. McCarter (Ed) and Dirk J. A. Van Zyl (Ed), Slope stability in Surface Mining, Society for Mining, Metallurgy, and Exploration, 442p, 2001
4. John Jaeger, N. G. Cook and Robert Zimmerman, Fundamentals of Rock Mechanics, 4 th Edition, Wiley-Blackwell; 4th edition, 488p, 2007.

Course Outcomes: Upon completion of this course, students will be able to,

1. Explain the concepts of slope geometry, stability, and groundwater influence in rock slopes.
2. Interpret geological and strength parameters relevant to rock slope design and stability.
3. Analyze plane and wedge failures using graphical and numerical methods.
4. Solve circular and toppling failure problems using Bishop's and Janbu's methods.
5. Design slope monitoring programs and propose effective slope stabilization techniques.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	INTRODUCTION TO QUANTUM TECHNOLOGIES (Programme Elective II)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce fundamental concepts of quantum mechanics and its mathematical formalism.
2. To explore quantum computing and communication principles and technologies.
3. To understand the physical implementation and limitations of quantum systems.
4. To enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
5. To familiarize students with the emerging trends in quantum technologies.

Unit 1

Fundamentals of Quantum Mechanics: Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrodinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian; Commutation relations and uncertainty principle; Quantum postulates and measurement theory; Eigenvalues, eigen functions.

Unit 2

Quantum Information Theory: Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation; Measurement in computational basis; Quantum teleportation and no-cloning theorem; Quantum state tomography (introductory).

Unit 3

Quantum Computing: Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance); Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, Introduction to quantum programming: Qiskit (overview)

Unit 4

Quantum Communication: Introduction to quantum cryptography; Quantum key distribution (QKD): BB84 protocol; Entanglement-based QKD: Ekert protocol (E91);



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Eavesdropping and security of QKD; Quantum teleportation (circuit and protocol); Quantum dense coding; Quantum networks and entanglement swapping; Role of quantum repeaters; Single-photon sources and detectors; Implementation challenges (loss, decoherence, noise).

Unit 5

Quantum Technologies and Applications: Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Quantum materials: topological insulators, graphene, quantum dots; NV centers in diamonds for sensing; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era.

Text Books:

1. "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang
2. "Quantum Mechanics: Concepts and Applications" by Nouredine Zettili

Course Outcomes: After completing this lab course, students will be able to,

1. Explain core principles of quantum mechanics and their technological implications.
2. Analyze quantum phenomena like superposition and entanglement.
3. Apply mathematical tools to model and solve quantum systems.
4. Demonstrate understanding of quantum algorithms and quantum circuits.
5. Evaluate potential applications and challenges in quantum communication and sensing.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	ADVANCED MINE SURVEYING LAB	L	T	P	C
		0	0	4	2

Course Objectives:

1. Understand advanced surveying instruments and techniques used in mine surveying.
2. Apply total station and GPS tools for data collection, contouring, and volume measurement.
3. Analyze and interpret mine-related spatial data using AutoCAD and GIS tools.
4. Evaluate subsidence and correlation survey methods using precision instruments.
5. Create digital mine plans and 3D models using modern geospatial technologies.

List of Experiments

1. Detailed surveying and contouring with Total Station.
2. Volume and stock measurement.
3. Plotting of sections using AUTOCAD.
4. Study of Gyro-theodolite.
5. Study of GPS & DGPS and data collection.
6. Weisbach Triangle method of Correlation survey .
7. Subsidence monitoring using 1" – Micro-optic Theodolite & Precise Level.
8. Digitization of Mine Plans.
9. Creation of 3D mine model using GPS data.
10. Satellite Image analysis using ArcGIS.

Course Outcomes: Upon completion of this lab course, students will be able to,

1. Demonstrate the use of total station for surveying and contour mapping.
2. Measure volumes and stocks accurately using surveying techniques.
3. Plot mine sections and digitize mine plans using AutoCAD and GIS tools.
4. Conduct correlation and subsidence surveys using theodolites and levels.
5. Generate 3D mine models and perform satellite image analysis using GPS and ArcGIS.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	MINE VENTILATION AND PLANNING LAB	L	T	P	C
		0	0	4	2

Course Objectives:

1. Understand the principles of mine ventilation and the measurement of air quantity and cooling power.
2. Analyze the functioning and performance characteristics of different types of mine fans.
3. Apply techniques for detection of mine gases and determination of Weisbach coefficient.
4. Evaluate ventilation networks and emergency equipment used in mine safety and rescue operations.
5. Develop and design efficient mine ventilation systems using simulation software.

List of experiments

- 1) Determination of air quantity.
- 2) Determination of air cooling power.
- 3) Detection of mine gases and construction of mine fans.
- 4) Study of performance of evasee.
- 5) Study of performance of fans in series.
- 6) Study of performance of fans in parallel.
- 7) Determination of weisbach coefficient.
- 8) Study and analysis of ventilation network.
- 9) Study of Fire extinguishers, rescue and reviving apparatus.
- 10) Study of various types of stopings and re-opening a sealed off area.
- 11) Konimeter, gravimetric dust sampler and personal dust sampler.
- 12) Design of ventilation system using VentSim software.

Course Outcomes: Upon completion of this lab course, students will be able to,

1. Measure air quantity and cooling power in mine environments.
2. Analyze the performance of fans in series, parallel, and with evasee attachments.
3. Detect mine gases and evaluate mine fan constructions and applications.
4. Interpret ventilation networks and assess the use of dust sampling and fire safety equipment.
5. Design and simulate mine ventilation systems using VentSim software.



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II Semester	SEMINAR II	L	T	P	C
		0	0	2	1

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

III Semester	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the knowledge on basics of research and its types.
- To impart the concept of Literature Review, Technical Reading, Attributions and Citations.
- To know the Ethics in Engineering Research.
- To know the concepts of Intellectual Property Rights in Engineering.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

	<i>Course Outcome</i>	<i>BTL (K#)</i>
CO1	Explain the meaning of engineering research and apply to develop an appropriate framework for research studies.	K2& K3
CO2	Identify the procedure of Literature Review, Technical Reading, etc. and apply to develop a research design during their project work.	K2 & K3
CO3	Explain and apply the fundamentals of patent laws and drafting procedure in their research works.	K2& K3
CO4	Demonstrate the copyright laws, subject matters of copyrights, designs etc. to apply in patent filing.	K2 & K3
CO5	Identify the new developments in IPR and employ the applications of computer software in writing/filing patents in future.	K2 & K3

Based on suggested Revised Blooms Taxonomy Level (BTL)

K1: Remember

K2: Understand

K3: Apply

K4: Analyse

K5: Evaluate

K6: Create

*Unit Description**Contact Hrs.***UNIT – I:****[10]**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations



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UNIT – II: **[10]**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT – III: **[10]**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – IV: **[10]**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT – V: **[09]**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR.

TEXTBOOKS:

1. C.R. Kothari , 2nd Edition, “Research Methodology: Methods and Techniques”.
2. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step-by-Step Guide for beginners”

REFERENCE BOOKS:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students.
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”.
3. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
4. Mayall, “Industrial Design”, McGraw Hill, 1992.
5. Niebel, “Product Design”, McGraw Hill, 1974.
6. Asimov, “Introduction to Design”, Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
8. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

WEB REFERENCES:

- Please include hyperlinks related to NPTEL/VLabs etc.,

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

III Semester	SUMMER INTERNSHIP	L	T	P	C
		0	0	0	3

COURSE OBJECTIVES:

- Internships provide students with an opportunity to put into practice skills they have learned while in college.
- In addition, students should have an opportunity to enhance those skills, obtain the perspective of a work environment and benefit from a mentor or supervisor's experience and advice.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

	<i>Course Outcome</i>	<i>BTL (K#)</i>
CO1	Integrate theory and practice to assess interests and abilities in their field of study.	K3 & K4
CO2	Develop work habits, attitudes necessary to appreciate work and its function in the economy.	K3
CO3	Develop communication, interpersonal and other critical skills to build a record of work experience.	K3

Based on suggested Revised Blooms Taxonomy Level (BTL)

K1: Remember

K2: Understand

K3: Apply

K4: Analyse

K5: Evaluate

K6: Create



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
R25 M.TECH MINING ENGINEERING SYLLABUS

III Semester	COMPREHENSIVE VIVA	L	T	P	C
		0	0	0	2

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

III Semester	DISSERTATION PART A	L	T	P	C
		0	0	20	10

COURSE OBJECTIVES:

- To impart fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
- To familiarise how to incorporate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- Expose to the critical aspects like identifying, analysing and solving problems creatively through sustained critical investigation using effective oral, written and visual communications.
- To inculcate the key aspects like awareness and application of appropriate personal, societal and professional ethical standards to excellence needed to engage in lifelong learning.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

	<i>Course Outcome</i>	<i>BTL (K#)</i>
CO1	Carryout a critical review of literature on a chosen topic of research and identify gaps in the literature to define a problem for research work.	K3 & K4
CO2	Formulate/adapt a clear methodology using multi-disciplinary approach and modern tools.	K3& K6

Based on suggested Revised Blooms Taxonomy Level (BTL)

K1: Remember

K2: Understand

K3: Apply

K4: Analyse

K5: Evaluate

K6: Create

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**
R25 M.TECH MINING ENGINEERING SYLLABUS

II Semester	DISSERTATION PART B	L	T	P	C
		0	0	32	16

COURSE OBJECTIVES:

- To impart fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
- To familiarise how to incorporate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- Expose to the critical aspects like identifying, analysing and solving problems creatively through sustained critical investigation using effective oral, written and visual communications.
- To inculcate the key aspects like awareness and application of appropriate personal, societal and professional ethical standards to excellence needed to engage in lifelong learning.

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

	Course Outcome	BTL (K#)
CO1	Carryout design/analysis of a product/system or devise experiments to study and develop a system/process/product.	K3 & K4
CO2	Interpret & validate results of analysis/experiments conducted to study behaviour of a product /system/ process considered for the research leading to valid conclusions that add value to the body of knowledge.	K3 & K5
CO3	Write and present a technical report of the project work.	K6

Based on suggested Revised Blooms Taxonomy Level (BTL)

K1: Remember

K2: Understand

K3: Apply

K4: Analyse

K5: Evaluate

K6: Create